

EVALUATION OF SEASONAL CLOSURES AS A MEANS OF OPTIMISING YIELD FROM A MULTI-SPECIES PRAWN FISHERY

Seasonal closures have been used as a means of optimising yield from Queensland's multi-species coastal prawn fisheries. Field studies and a log book data base have demonstrated that the fishery is supported by six penaeid species, four of which are significant contributors to the fishery. Species composition has varied significantly across distances as little as 100 km, and both the timing and strength of recruitment has varied during the two years (1989-1990) in which sampling took place.

A deterministic model, based upon Thompson and Bell's (1934) yield model, has been used as an initial means of estimating yield (weight of prawn and dollar value) from a given recruitment sequence. The model allows for variable recruitment timing, species composition and mortality. It has the advantages of being mathematically simple, flexible in respect of variability in input parameters, and readily adapted to either spreadsheet or microcomputer programming. Input parameters have been estimated from data obtained in tagging and field sampling programmes (Gribble and Dredge, 1991), or from published literature. There is a wide range of scenarios under which the model can be run. By varying growth and mortality parameters, potential yield from the fishery can be established across normally acceptable ranges of these parameters.

The major role of the model was to test the value of yield under a seasonal closure regime of management. Under a conventional scenario of constant fishing mortality, output from the model suggests that closures had little positive or negative effect upon yield from the fishery. In economic terms, the closure would thus appear to be of little benefit to

industry. However, log book data clearly indicate that immediately following the cessation of closures, the fishery undergoes a heavy pulse of effort, which diminishes as the fishing season progresses. Under such a regime of fishing mortality, the model suggests that yield is increased as a consequence of the closures. This is achieved as a consequence of higher exploitation rates of the stocks. The subsequent output from reduced spawning stocks remains to be determined.

The variability of recruitment dynamics in this fishery indicates that seasonal closures are unlikely to optimise yield unless carried out on a regional basis, in conjunction with a detailed sampling programme. The authors intend to investigate the spatial dynamics of the fished species and incorporate these data into an evaluation of spatial closures as an alternative means of optimising the fishery.

Literature Cited

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THE WHITE SHRIMP (*PENAEUS SETIFERUS*) FISHERY IN THE CAMPECHE BANK, MEXICO

The white shrimp *Penaeus setiferus* (Linnaeus, 1767) is amongst the most economically important penaeid species in the southwestern Gulf of Mexico, with more than 1000 tonnes caught annually. It supports three different fisheries in the area: an artisanal estuarine fishery, a drift net fishery offshore and the industrial trawl fishery. Relationships between these fisheries were analysed using yield per recruit models. Interaction between sequential fisheries (estuarine artisanal versus marine fisheries) is relatively low, as the estuarine fishery on white shrimp is small. Nevertheless, artisanal estuarine exploitation could exert a negative effect on the marine white shrimp fishery if the fishing effort increases inshore. Parallel offshore interaction (drift net and trawling fisheries) is stronger, since the types of gear used in the artisanal marine fishery are very efficient at catching white shrimp. This fishery is selective on large mature shrimp. Catches of the parallel fisheries are inversely related. However, the investment, costs, and benefits of the drift net fishery make this activity highly profitable and competitive with the industrial trawl fishery. A simulation model of the effect of the three fisheries suggested that the 1984 fishing effort was nearing the critical reproductive biomass.

The white shrimp spawns throughout the year, resulting in continuous recruitment. However, seasonal variations in recruitment result in periods of low and high abundance. The relationship between spawning and recruitment did not show a significant correlation ($0.2 > P > 0.01$) when analysed as biological years. This lack of correlation is attributed to the effect of environmental factors, as well as inter-annual variability of recruitment strength in the main cohorts throughout the year. A Ricker Stock-recruitment relationship ($P > 0.001$) was established for dominant cohorts in the 1973-1984 study period. The explained variance increased from 70% to 84% when the model included the rivers' discharge during the previous recruitment month and during the spawning period four months prior. The river discharge has both negative and positive effects on recruitment. Its increase during spawning time can restrict the habitat available for successful establishment of shrimp postlarvae, but on the positive side, a drop in salinity can trigger juveniles to migrate to sea. The recruitment level depends largely upon the carrying capacity of critical nursery habitats. White shrimp adopt an opportunistic strategy to efficiently exploit the seasonal variations in estuarine carrying capacity associated with river discharge.

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